

R E M A R K S

U P O N

THE SOLAR AND THE LUNAR YEARS,

The Cycle of 19 Years, commonly called

THE GOLDEN NUMBER,

THE EPACT,

And a Method of finding the Time of
Easter, as it is now observed in most
Parts of *Europe*.

Being Part of a LETTER from

The Right Honourable

Packer
GEORGE EARL OF MACCLESFIELD

to

Martin Folkes Esq; *President* of the *Royal Society*,

and by him communicated to the same,

May 10. 1750.

L O N D O N:

Printed for CHARLES DAVIS, Printer to the
Royal Society.

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R E M A R K S

U P O N

THE SOLAR AND THE LUNAR YEARS

The Mode of which is commonly called

THE GOLDEN NUMBER

THE EPOCH

And a Method of finding the Time of

its being as it is now observed in most

Parts of Europe

By J. B. de la Motte

The Right Honourable

GEORGE EARL OF MARCHMONT

Author of the History of the Royal Society

and by him communicated to the Public

London 1750

L O N D O N

Printed for Charles D'Almeida, Printer to the

Royal Society

M D C C L I

A TABLE, shewing, by means of the Golden Numbers, the several Days on which the Paschal Limits or Full Moons, according to the *Gregorian* Account, have already happened, or will hereafter happen; from the Reformation of the Calendar in the Year of our Lord 1582, to the Year 4199 inclusive.

To find the Day on which the Paschal Limit or Full Moon falls in any given Year; Look, in the Column of Golden Numbers belonging to that Period of Time wherein the given Year is contained, for the Golden Number of that Year; over-against which, in the same Line continued to the Column intitl'd *Paschal Full Moons*, you will find the Day of the Month, on which the Paschal Limit or Full Moon happens in that Year. And the *Sunday* next after that Day is *Easter Day* in that Year, according to the *Gregorian Account*.

Golden Numbers from the Year 1583 to 1699, and so on to 4199, all inclusive.																Paschal Full Moons.
1583 to 1699	1700 to 1899	1900 to 2199	2200 to 2299	2300 to 2399	2400 to 2499	2500 to 2599	2600 to 2899	2900 to 3099	3100 to 3399	3400 to 3499	3500 to 3599	3600 to 3699	3700 to 3799	3800 to 4099	4100 to 4199	Days of the Month, and Sunday Letters
3	14	..	6	17	6	17	..	9	..	1	12	1	12	..	4	March 21. C
..	3	14	..	6	..	6	17	..	9	..	1	..	1	12	..	22. D
11	..	3	14	..	14	..	6	17	..	9	..	9	..	1	12	23. E
..	11	..	3	14	3	14	..	6	17	..	9	..	9	..	1	24. F
19	..	11	..	3	..	3	14	..	6	17	..	17	..	9	..	25. G
8	19	..	11	..	11	..	3	14	..	6	17	6	17	..	9	26. A
..	8	19	..	11	..	11	..	3	14	..	6	..	6	17	..	27. B
16	..	8	19	..	19	..	11	..	3	14	..	14	..	6	17	28. C
5	16	..	8	19	8	19	..	11	..	3	14	3	14	..	6	29. D
..	5	16	..	8	..	8	19	..	11	..	3	..	3	14	..	30. E
13	..	5	16	..	16	..	8	19	..	11	..	11	..	3	14	31. F
2	13	..	5	16	5	16	..	8	19	..	11	..	11	..	3	April 1. G
..	2	13	..	5	..	5	16	..	8	19	..	19	..	11	..	2. A
10	..	2	13	..	13	..	5	16	..	8	19	8	19	..	11	3. B
..	10	..	2	13	2	13	..	5	16	..	8	..	8	19	..	4. C
18	..	10	..	2	..	2	13	..	5	16	..	16	..	8	19	5. D
7	18	..	10	..	10	..	2	13	..	5	16	5	16	..	8	6. E
..	7	18	..	10	..	10	..	2	13	..	5	..	5	16	..	7. F
15	..	7	18	..	18	..	10	..	2	13	..	13	..	5	16	8. G
4	15	..	7	18	7	18	..	10	..	2	13	2	13	..	5	9. A
..	4	15	..	7	..	7	18	..	10	..	2	..	2	13	..	10. B
12	..	4	15	..	15	..	7	18	..	10	..	10	..	2	13	11. C
1	12	..	4	15	4	15	..	7	18	..	10	..	10	..	2	12. D
..	1	12	..	4	..	4	15	..	7	18	..	18	..	10	..	13. E
9	..	1	12	..	12	..	4	15	..	7	18	7	18	..	10	14. F
..	9	..	1	12	1	12	..	4	15	..	7	..	7	18	..	15. G
17	..	9	..	1	..	1	12	..	4	15	..	15	..	7	18	16. A
6	17	17	9	..	9	..	1	12	12	4	15	4	15	15	7	17. B
14	6	6	17	9	17	9	9	1	1	12	4	12	4	4	15	18. C
																19. D
																20. E
																21. F
																22. G
																23. A
																24. B
																25. C

10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	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Colleen Mullins from the Yacht Club of New York City

The first of these is the fact that the
 government has been unable to
 maintain a stable exchange rate
 since the early 1980s. This has
 led to a loss of confidence in the
 government and a consequent
 increase in inflation. The second
 factor is the fact that the
 government has been unable to
 maintain a stable budget. This has
 led to a loss of confidence in the
 government and a consequent
 increase in inflation. The third
 factor is the fact that the
 government has been unable to
 maintain a stable economy. This has
 led to a loss of confidence in the
 government and a consequent
 increase in inflation.

one foot - 438' to the Year 1800 including
 bent, or will register paper; from the termination of the deposit in the Year of
 1848, Prince of Earl Moore, according to the General Account, this present part
 A TABLE, showing, Payments of the Collier's, the General of the Collier's, the

*Remarks upon the Solar and the Lunar Years,
the Cycle of 19 Years, commonly called the
Golden Number, the Epact, and a Me-
thod of finding the Time of Easter, as it is
now observed in most Parts of Europe.
Being Part of a Letter from the Right
Honourable George Earl of Macclesfield
to Martin Folkes Esq; President of the
Royal Society.*

Of the Solar Year.

Read May 10. 1750. **T**HE mean *Tropical Solar Year*, or that mean Space of Time wherein the Sun, or Earth, after departing from any Point of the *Ecliptic* returns to the same again, consists, according to Dr. *Halley's Tables*, of $365^{\text{d}}, 5^{\text{h}}, 48', 55''$: Which is less by $11', 5''$, than the mean *Julian Year*, consisting of $365^{\text{d}}, 6^{\text{h}}, 0', 0''$.

Hence the *Equinoxes* and *Solstices* anticipate, or come earlier than the *Julian Account* supposes them to do by $11', 5''$, in each mean *Julian Year*; or $44', 20''$ in every four; or $3^{\text{d}}, 1^{\text{h}}, 53', 20''$, in every four hundred *Julian Years*.

In order to correct this Error in the *Julian Year*, the Authors of the *Gregorian Method* of regulating the Year, when they reformed the Calendar in the Beginning of *October 1582*, directed that three intercalary Days should be omitted or dropped in every four hundred Years; by reckoning all those Years,

*

whose

whose Date consists of a Number of entire Hundreds not divisible by 4, such as 1700, 1800, 1900, 2100, &c. to be only Common, and not Bissextile or Leap Years, as they would otherwise have been; and consequently omitting the intercalary Days, which, according to the *Julian* Account, should have been inserted in the Month of *February* in those Years. But at the same time they order'd that every fourth hundredth Year, consisting of a Number of entire Hundreds, divisible by 4, such as 1600, 2000, 2400, 2800, &c. should still be consider'd as Bissextile or Leap Years, and, of consequence, that one Day should be intercalated as usual in those Years.

This Correction, however, did not entirely remove the Error: For the Equinoxes and Solstices still anticipate $1^h, 53', 20''$ in every four hundred *Gregorian* Years.

But that Difference is so inconsiderable as not to amount to twenty-four Hours, or to one whole Day, in less than 5082 *Gregorian* Years.

Of the Lunar Year, Cycle of 19 Years, and the Epact.

The Space of Time betwixt one mean Conjunction of the Moon with the Sun and the next following, or a mean *Synodical Month*, is equal to $29^d, 12^h, 44', 3'', 2''', 56'''$, according to Mr. *Pound's* Tables of mean Conjunctions.

The Common Lunar Year consists of 12 such Months.

The

The Intercalary or *Embolimæan* Year consists of 13 such Months.

In each Cycle of 19 Lunar Years, there are 12 Common, and 7 Intercalary or *Embolimæan* Years, making together 235 Synodical Months.

It was thought, at the time of the General Council of *Nice*, which was holden in the Year of our Lord 325, that 19 *Julian* Solar Years were exactly equal to such a Cycle of 19 Lunar Years, or to 235 Synodical Months; and therefore, that, at the End of 19 Years, the New Moons or Conjunctions would happen exactly at the same Times, as they did 19 Years before: And upon this Supposition it was, that, some time afterwards, the several Numbers of that Cycle, commonly called the Golden Numbers, were prefixed to all those Days in the Calendar, on which the New Moons then happened in the respective Years corresponding to those Numbers; it being imagined, that whensoever any of those Numbers should for the future be the Golden Number of the Year, the New Moons would invariably happen on those Days in the several Months, to which that Number was prefixed.

But this was a Mistake:

For 19 <i>Julian</i> Solar Years contain	6939, 18, 0, 0, 0
Whereas 235 Synodical Months	} 6939, 16, 31, 56, 30
contain only	
And are therefore less than 19	} 0, 1, 28, 3, 30.
<i>Julian</i> Solar Years by	

This Difference amounts to a whole Day very nearly in 310.7 Years, the New Moons anticipating,

*

or

or falling earlier, by 24 Hours in that Space of Time, than they did before : And therefore now in the Year 1750, the New Moons happen above four Days and a half sooner, than the Times pointed out by the Golden Numbers in the Calendar.

In order therefore to preserve a sort of regular Correspondence betwixt the Solar and the Lunar Years, and to make the Golden Numbers, prefixed to the Days of the Month, useful for determining the Times of the New Moons, it would be necessary, when once those Golden Numbers should have been prefixed to the proper Days, to make them anticipate a Day at the End of every 310.7 Years, as the Moons will actually have done; that is to set them back one Day, by prefixing each of them to the Day preceding that, against which they before stood.

But as such a Rule would neither be so easily comprehended or retained in Memory, as if the Alteration was to be made at the End or at the Beginning of complete Centuries of Years; the Rule would be much more fit for Practice, and keep sufficiently near to the Truth, if those Numbers should be set back nine Days in the Space of 2800 Years; by setting them back one Day, first at the End of 400 Years, and then at the End of every 300 Years for eight times successively: whereby they would be set back, in the whole, nine Days in 2800 Years. After which they must again be set one Day back at the End of 400 Years, and so on, as in the preceding 2800 Years. By which means the Golden Numbers would always point out the mean Times of the New Moons, within a Day of the Truth.

It

It is plain however that the Lunar Year will have lost one Day more than ordinary, with respect to the Solar Year, whenever the New Moons shall have anticipated a whole Day; as they will have done at those times, when it is necessary that the Golden Numbers should, by the Rule just now given, be set back one Day: and consequently the Epact, for that and the succeeding Years, must exceed by an Unit the several corresponding Epacts of the preceding 19 Years.

For the Epact is the Difference, in whole Days, betwixt the common *Julian* Solar and the Lunar Year; the former being reckoned to consist of 365, and the latter of only 354 Days. If therefore the Solar and the Lunar Year at any time should commence on the same Day, the Solar would, at the End of the Year, have exceeded the Lunar by 11 Days; which Number 11 would be the Epact of the next Year: 22 would be the Epact of the Year following, and 33 the Epact of the Year after that, the Epacts increasing yearly by 11. But as often as this yearly Addition makes the Epact exceed 30, those 30 are rejected as making an intercalary Month, and only the Excess of the Epact above 30 is accounted the true Epact for that Year. Thus when the Epact would amount to 31, 32, 33, 34, &c. the 30 is rejected, and the Epact becomes 1, 2, 3, 4, &c.

Since therefore the Lunar Year will have lost a Day more than ordinary, in respect of the Solar Year, whenever it is necessary to set the Golden Numbers one Day back, as was before observed; it follows, that the Epact must at the same time be increased by an Unit more than usual: the Difference betwixt the Solar and the Lunar Year having been just so

much

much greater than usual. That is, 12 must be added, instead of 11, to the Epact of the preceding, in order to form what will be the Epact of the then present Year. Which Addition of an Unit extraordinary to one Epact will occasion all the subsequent Epacts (which will follow each other in the usual manner, each exceeding the foregoing by 11) to be greater by an Unit than their respectively corresponding Epacts of the preceding 19 Years.

If therefore, instead of the Golden Numbers, the Epacts of the several Years were prefixed, in the manner the *Gregorians* have done, to the Days of the Calendar, in order to denote the Days on which the New Moons fall in those Years whereof those Numbers are the Epacts; there would never be Occasion to shift the Places of those Epacts in the Calendar; since the Augmentation by an Unit extraordinary of the Epacts themselves would answer the Purpose, and keep all tolerably right.

Thus in a very easy Method may the Course of the New Moons be pointed out, either by the Golden Numbers, or by the Epacts, according to the *Julian* Account or Manner of adjusting the Year, which goes on regular and uniform without any Variation.

But the regulating these things for those who use the *Gregorian* Account, is an Affair of more Intricacy; and for them it will require more Consideration to determine, when the Epacts are to be more than ordinarily augmented, and at what Times they are to continue in their usual Course; nay, to know when they are not only not to be extraordinarily augmented, but also when they are to be diminished by an Unit, by increasing one of them by 10 only instead of 11 as usual: and this happens much oftener with the
Gregorians,

Gregorians, than the increasing one of them by 12 instead of 11. For, in every *Gregorian* Solar Year, whose Date consists of any Number of entire Hundreds not divisible by 4, it is supposed that the Equinox has anticipated one whole Day; and therefore one Day, that which ought to be the intercalary one, is omitted; and consequently the preceding Solar Year, where one Day was lost, exceeded the Lunar Year by 10 Days only instead of 11.

In order therefore to adapt the before-mention'd Rule to the *Gregorian* Account, and to know in what Years the Epacts should either be extraordinary augmented or diminished, and the Golden Numbers should either be set backwards or forwards in the Calendar; the following Rules and Directions must be observed.

First. That in the Years 1800, 2100, 2700, 3000, &c. where the Number of entire Hundreds is divisible by 3, but not by 4, the *Gregorian* Solar, as well as the Lunar Year, will have lost a Day; and consequently the Difference betwixt them will be the same as usual: Therefore in those Years there must be no Alteration, either in the Epacts or the Golden Numbers; but the former must go on in the same manner, and the latter stand prefixed to the same Days in the Calendar, for another, as they did for the last hundred Years.

2dly. The like will happen in the Years 2000, 2800, 3200, &c. where the Number of entire Hundreds is divisible by 4, but not by 3: For neither the *Gregorian* Solar nor the Lunar Year is to be altered; and therefore the Epacts must go on, and the Golden Numbers stand, as they did before.

But,

But, 3dly, In the Years 2400, and 3600, whose Number of entire Hundreds is divisible both by 3 and 4, the *Gregorian* Solar Year goes on as usual, and the Lunar Year has lost a Day. The Difference therefore betwixt them being 12, the Epact of the preceding Year must be augmented by that Number instead of 11, in order to form the Epact of the then present Year; whereby a new Set of Epacts will be introduced, exceeding their precedent corresponding Epacts by an Unit: And the Golden Numbers must be set one Day back in the Calendar.

4thly and lastly, In the Years 1900, 2200, 2300, 2500, &c. where the Number of Hundreds is divisible neither by 3 nor 4; the *Gregorian* Solar Year having lost one Day, and the Lunar none, the Difference betwixt them being only 10; that Number only, and not 11, is to be added to the Epact of the preceding, in order to form the Epact of that, the then present Year; whereby a new Set of Epacts will be introduced, all of them less by an Unit than their precedent corresponding Epacts: And the Golden Numbers must be set a Day forwarder in the Calendar; that is, be prefixed to the Day following that, against which they stood in the precedent hundred Years.

This Method would preserve a sort of Regularity betwixt the Solar and the Lunar Years; and, by means of the Rules and Directions before-mentioned, the Days of the New Moons might be pointed out, either by the Golden Numbers or by the Epacts, placed in the Calendar for that Purpose; according to the *Julian* Account for ever, and according to the *Gregorian* Account till the Year 4199 inclusive, after which

which there must be some little Variation made in the four last Precepts or Rules; but it would be to little Purpose now, to attempt the framing of a new Set of Rules for so distant a Time.

The *Gregorians* have chosen to make use of the Epacts to determine the Days of the New Moons; and follow pretty nearly the Rules prescribed above; except that they order the Epacts to have an additional Augmentation of an Unit eight times in 2500 Years, beginning with the Year 1800, as at the End of 400 Years; to which 400 Years if there be added three times seven hundred, or 2100 Years, the Period of 2500 Years will be completed in the Year 3900. After which they do not make their extraordinary Augmentation of an Unit in the Epacts, till at the End of another Term of 400 Years; which defers that Augmentation from the Year 4200 to the Year 4300. And this is the Reason that the Rules above delivered will require a Variation in the Year 4200; whereas it is directed in this Paper that the Epacts should be augmented, or (which is the same thing) the Golden Numbers be set back in the Calendar nine times in 2800 Years. This arises from the *Gregorians* supposing, that the Difference betwixt 19 Solar and as many Lunar Years would not amount to a whole Day in less than 312 Years and a half; whereas it has appeared above, that it would amount to a whole Day in 310.7 Years. But although the Rule prescribed in this Paper comes much nearer to the Truth, yet the Error in either Case is very inconsiderable, being so small as not to amount to a whole Day in many thousand Years; and therefore is not worth regarding.

A Method of finding the Time of Easter, as it is observed in most Parts of Europe.

From what has been already said, a Method may be obtained, for fixing, with sufficient Exactness, the Time of the Celebration of the Feast of *Easter*, which is governed by the *Vernal Equinox*, and by the Age of the Moon nearest to it. The former whereof, when once rightly adjusted, may (by the Corrections mentioned in that Part of this Paper which relates to the Solar Year) be made to continue to fall at very near the same time with, or at most not to differ a whole Day from the true *Equinox*: and the same Rules and Directions, which, as was before shewn, would, without any great Error, point out the Times of the first Day of the Moon, would with equal Certainty point out the fourteenth, fifteenth, or any other: And thus the Times of the Oppositions or the Full Moons might be as well marked out thereby, as those of the Conjunctions or the New Moons.

I shall not at present take notice of the Canon of the Council of *Nice*, in the Year of our Lord 325, which directs the Time of celebrating the Feast of *Easter*, or of the Reasons upon which that Canon was founded. Nor shall I endeavour to explain the Rule now in Use in the Church of *England* for finding *Easter*: For, besides that such an Explanation would extend this Paper to an improper Length, those Points have already been treated of by several much abler Hands, and particularly by our Countryman the learned Dr. *Prideaux*. Nor is it my Intention to enter far into the

the Methods used by the *Gregorians*, or those of the Church of *Rome*, or by any other Nations or Countries, for finding the Time of that Feast. As to our own, I shall only observe, that the Method now used in *England*, for finding the fourteenth Day of the Moon, or the Ecclesiastical Full Moon, on which *Easter* dependeth, is, by Process of Time, become considerably erroneous: as the Golden Numbers, which were placed in the Calendar, to point out the Days on which the New Moons fall in those Years of which they are respectively the Golden Numbers, do now stand several Days later in the same than those New Moons do really happen. Which Error, as was before observed, arises from the Anticipation of the Moons since the Time of the Council of *Nice*: And as the *Vernal Equinox* has also anticipated eleven Days since that time; neither that Equinox, nor the New Moons, do now happen on those Days upon which the Church of *England* supposes them so to happen.

When Pope *Gregory XIII.* reformed the *Julian* Solar Year, he likewise made a Correction as to the Time of celebrating the Feast of *Easter*, by placing the Epacts (which he directed to be made use of for the future instead of the Golden Numbers) much nearer to the true Times of the New Moons than the Golden Numbers then stood in the old Calendar: I say, *much nearer to the true Times*; because in fact the Epacts, as placed by him, were not prefixed to the exact Days upon which the New Moons then truly fell. And this was done with Design, and for a Reason which it is not material to the Purpose of this Paper to mention.

But the Church of *England*, and that of *Rome* or the *Gregorians*, do still agree in this; that both of them mark (the former by the Golden Numbers, and the latter by the Epacts corresponding to them) the Days on which their Ecclesiastical New Moons are supposed to happen: And that fourteenth Day of the Moon inclusive, or that Full Moon, which falls upon, or next after, the 21st Day of *March*, is the Paschal Limit or Full Moon to both: And the *Sunday* next following that Limit or Full Moon, is by both Churches celebrated as *Easter* Day. But the 21st of *March* being reckoned, according to the *Gregorian* Account or the New Style, eleven Days sooner than by the *Julian* Account or the Old Style, which is still in Use amongst us; and their Ecclesiastical New Moons being three Days earlier than those of the Church of *England*; it happens that although the Church of *England* and that of *Rome* often do, yet more frequently they do not, celebrate the Feast of *Easter* upon the same natural Day.

It might however be easier for both, and could occasion no Inconvenience, now that Almanacks, which tell the exact Times of the New Moons, are in most Peoples Hands; if all the Golden Numbers and Epacts now prefixed to those Days of the Calendar, in our Book of Common Prayer, and in the *Roman Breviary*, on which the respective Ecclesiastical New Moons happen, were omitted in the Places where they now stand; and were set only against those fourteenth Days of the Moon, or those Full Moons, which happen betwixt the 21st Day of *March* and the 18th of *April*, both inclusive. Since no fourteenth Day or Full Moon, which happens before the 21st
of

of *March*, or after the 18th Day of *April*, can have any Share in fixing the Time of *Easter*. By which means the Trouble of counting to the fourteenth Day, and the Mistakes which sometimes arise therefrom, would be avoided.

We do as yet in *England* follow the *Julian* Account or the Old Style in the Civil Year; as also the Old Method of finding those Moons upon which *Easter* depends: Both of which have been shewn to be very erroneous.

If therefore this Nation should ever judge it proper to correct the Civil Year, and to make it conformable to that of the *Gregorians*, it would surely be adviseable to correct the Time of the Celebration of the Feast of *Easter* likewise, and to bring it to the same Day upon which it is kept and solemnized by the Inhabitants of the greatest Part of *Europe*, that is, by those who follow the *Gregorian* Account. For tho' I am aware, that their Method of finding the Time of *Easter* is not quite exact, but is liable to some Errors; yet I apprehend, that all other practicable Methods of doing it would be so too: And if they were more free from Error, they would probably be more intricate, and harder to be understood by Numbers of People, than the Method of determining that Feast either by a Cycle of Epacts, as is practiced by the *Gregorians*, or by that of 19 Years or the Golden Numbers, in the manner proposed in the following Part of this Paper: And it is of no small Importance, that a Matter of so general a Concern, as the Method of finding *Easter* is, should be within the Reach of the Generality of Mankind, at least as far as the Nature of the thing will admit.

For

For which Reason, in case the Legislature of this Country should before the Year 1900, think fit to make our Civil Year correspond with that of the *Gregorians*, and also to celebrate all the future Feasts of *Easter* upon the same Days upon which they celebrate them; this last Particular might be easily effected, without altering the Rule of the Church of *England* for the finding of that Feast: And this only by advancing the Golden Numbers, prefixed to certain Days in the Calendar, 8 Days forwarder for the New Moons, or 21 Days forwarder for the fourteenth Days or Full Moons, than they now stand in our Calendar.

In order to explain this, it must be observed, that the *Gregorian* Account or the New Style is eleven Days forwarder than the *Julian* Account or the Old Style, which we still make use of; that is, the last Day of any of our Months is the eleventh Day of their next succeeding Month. If therefore their Ecclesiastical New Moons fell on the same Days with those of the Church of *England*, the Golden Number 14, which now stands against the last Day of *February* in our that is the *Julian* Calendar, should, when we should have adopted the *Gregorian* Calendar, be prefixed to the 11th Day of *March*. But since their Ecclesiastical New Moons happen 3 Days earlier than our Ecclesiastical New Moons at present do; so much should be deducted from those 11 Days, by which the Golden Numbers ought otherwise to be advanced; and the Golden Number 14 should not be placed against the 11th, but the 8th Day of *March*: Which being reckoned the first Day of the Moon, if we count on to the fourteenth Day of the same inclusive, that would be found to fall on the 21st Day of *March*; on which
Day

Day the *Gregorian* Paschal Limit or Full Moon will happen when the Golden Number is 14. And the like Course should be taken with the rest of the 19 Golden Numbers; which ought to be placed 8 Days forwarder than they now stand, if they are to point out the New Moon; or 21 Days forwarder than they are at present, if they are to mark the fourteenth Day of the Moon or the Full Moon: The latter of which, as has been shewn, would be more eligible, than to prefix those Numbers to the Days on which the New Moons happen.

Thus may the Rule and Method now used in the Church of *England*, be most easily adapted to shew the Time of *Easter*, as it is observed by the *Gregorians*, till the Year 1900; at which Time, and at the other proper succeeding Times, if the Golden Numbers in the Calendar shall either be advanced or set backward a Day, according the foregoing Rules and Directions for that Purpose, they will continue to shew us the New or the Full Moons, of the Church of *Rome* or the *Gregorian* Calendar with great Exactness, till the Year 4199: when, as has been already mentioned, there must be a little Variation made in those Rules and Directions.

There is however one Exception to those General Rules and Directions, which will be taken notice of in the next Paragraph.

Upon these Principles I framed the Table accompanying this Paper, and shewing, by means of the Golden Numbers, all the *Gregorian* Paschal Limits or Full Moons, from the Reformation of the Calendar, &c. by Pope *Gregory* to the Year 4199 inclusive. Which Space of Time is therein divided into sixteen unequal Portions or Periods; at the Beginning of each

each of which, all the Golden Numbers, when once they shall have been properly placed in the Calendar, must either be advanced or set back one Day, with respect to the Place where they stood in the preceding Period, agreeably to the foregoing Rules: Except those Numbers which shall happen to stand against the 4th and 5th of *April* to shew the Paschal New Moons, or against the 17th and 18th of the same Month to mark out the Paschal Full Moons; both which Numbers at some Times, and only one of them at others, must keep the same Place for that, which was allotted to them in the immediately preceding Period.

In order to determine at what Times, and on what Occasions, this Exception is to take Place; let it be observed, that, in the Months of *January*, *March*, *May*, and some others in our present Calendar, as well as in the Table above mentioned, some of the Golden Numbers stand double or in Pairs, and follow one the other immediately; whilst others, on the contrary, generally stand single and by themselves.

Now, when any of those Pairs, or two Numbers which usually accompany each other, happen, in pursuance of the foregoing Rules, to be prefixed the one to the 4th and the other to the 5th of *April* for the New Moons, or the one to the 17th and the other to the 18th of *April* for the Paschal Limits or Full Moons: And when any of those Numbers, which generally stand single, are prefixed, according to the said Rules, to the 5th of *April* for the New Moons, or to the 18th for the Full Moons: In these Cases those Pairs or single Numbers that are so situated, must not be set forward or advanced at the Beginning

ning of the next Period, but must keep their Places during another Period, if the foregoing Rules direct all the Golden Numbers to be advanced a Day; which must be complied with in respect to all the other Golden Numbers, except those so situated as above. Instances whereof may be seen in the Table, under the respective Periods beginning with the Years 1900, 2600, 3100, and 3800.

But if, in Conformity to the foregoing Rules, all the Golden Numbers are to be set one Day backward; those Pairs or single Numbers, tho' situated as is above-mentioned, must not keep their Places, but must move one Day backward like all the other Golden Numbers; as they may be seen to do in the Periods beginning with the Years 2400 and 3600.

To give a plain and intelligible Account of the Reason, on which the Directions now given with respect to this Exception are founded, would extend this Paper, already too long, far beyond its due and proper Bounds. I shall therefore content myself with observing, that it depends chiefly upon the Nature of the *Menses Pleni* and *Menses Cavi*, into which the Lunar Year is usually divided: and that, in order to make use of the Golden Numbers for finding the Time of the *Gregorian Easter*, it will be necessary not only to conform to the general Rules laid down in the former Part of this Paper; but also to follow the Directions just now given, with respect to the above-mentioned Exception to those general Rules.

But I should not do Justice to *Peter Davall*, of the *Middle Temple*, Esq; Secretary of the *Royal Society*,

Society, did I not here acknowledge, that, before I had so fully considered these Matters as I have since done, I had the first Hint of applying the Golden Numbers to find the *Gregorian* Paschal Limit or full Moon, from him; who has since that time composed and drawn up Tables, &c. which may possibly be of considerable and general Use in this Nation hereafter.

But in Conformity to the foregoing Rules, all the Golden Numbers are to be set one Day back; and those Pairs or single Numbers, the former as is above-mentioned, must not keep their Places, but must move one Day backward like all the other Golden Numbers; as they may be seen to do in the Tables beginning with the Year 1700 and 1701. To give a plain and intelligible Account of the Reason on which the Directions now given with respect to this Exception are founded, would extend this Paper, already too long, far beyond its due and proper Bounds. I shall therefore content myself with observing, that it depends chiefly upon the Nature of the *Metaphysical* and *Metaphysical* Cycles, into which the Lunar Year is usually divided: and that in order to make use of the Golden Numbers for finding the Time of the *Gregorian* Easter, it will be necessary not only to conform to the general Rules laid down in the former Part of this Paper; but also to follow the Directions just now given, with respect to the above-mentioned Exception to those general Rules.

But I should not do Justice to *Peter Darnley*, of the *Middle Temple*, Esq; Secretary of the *Royal Society*.